Figure 1

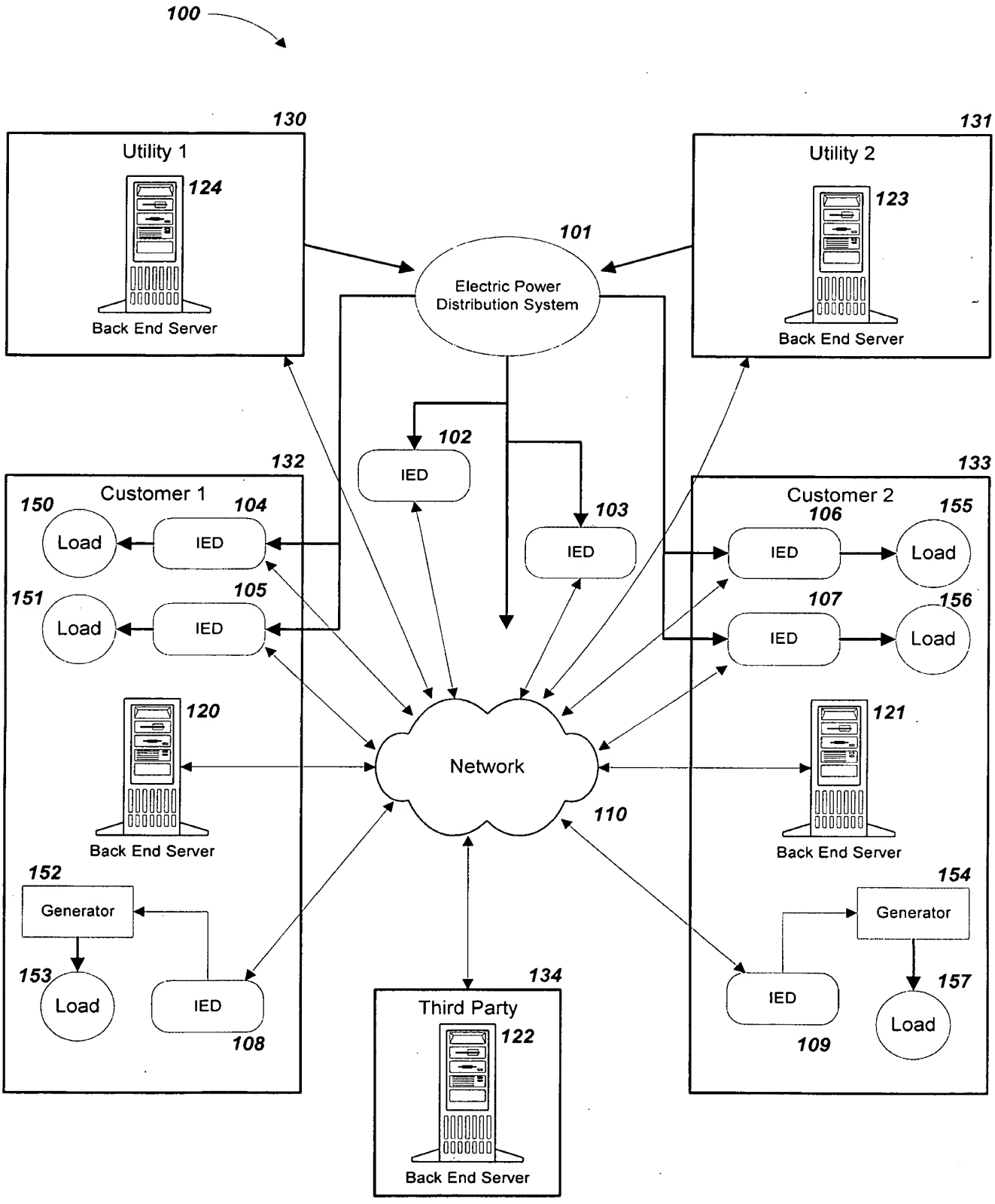

100
130
Utility 1
124
Back End Server
131
Utility 2
123
Back End Server
101
Electric Power Distribution System
102
IED
103
IED
132
Customer 1
150
Load
104
IED
151
Load
105
IED
120
Back End Server
152
Generator
153
Load
IED
108
133
Customer 2
106
IED
155
Load
107
IED
156
Load
121
Back End Server
154
Generator
157
Load
IED
109
Network
110
134
Third Party
122
Back End Server

Figure 2a

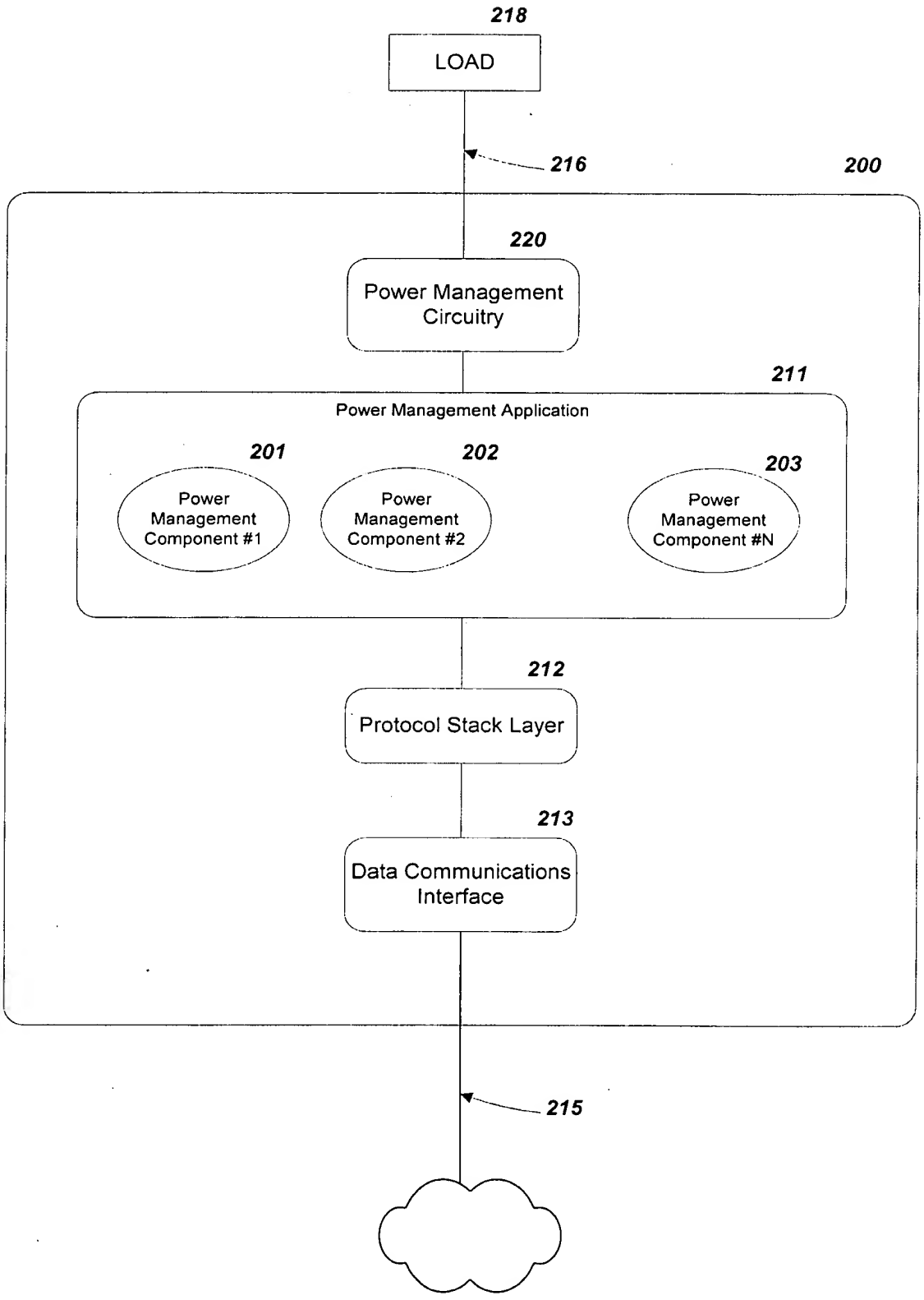

218
LOAD
216
200
220
Power Management Circuitry
211
Power Management Application
201
Power Management Component #1
202
Power Management Component #2
203
Power Management Component #N
212
Protocol Stack Layer
213
Data Communications Interface
215

Figure 2b

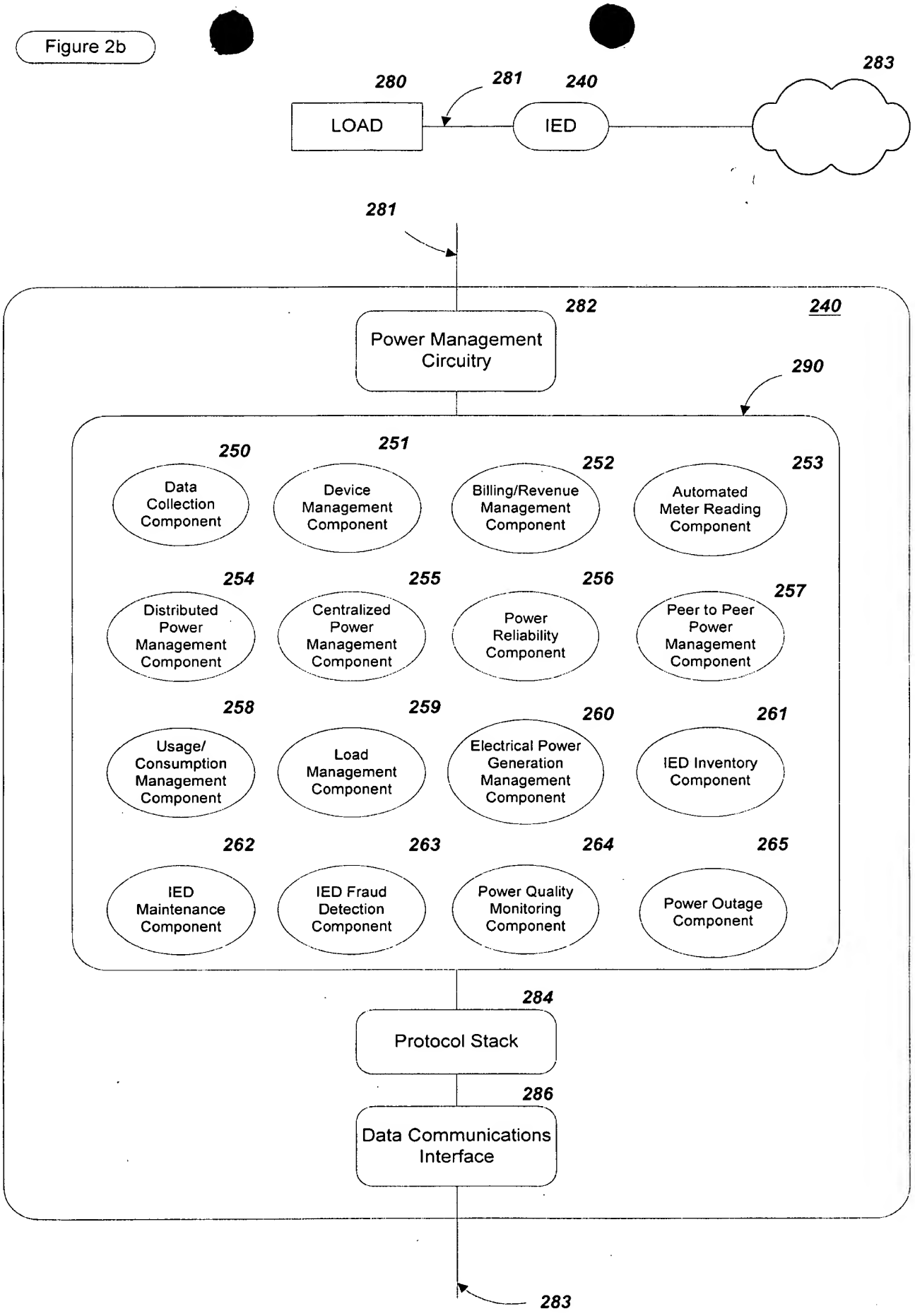

280
281
240
283
LOAD
IED
281
240
282
Power Management Circuitry
290
250
Data Collection Component
251
Device Management Component
252
Billing/Revenue Management Component
253
Automated Meter Reading Component
254
Distributed Power Management Component
255
Centralized Power Management Component
256
Power Reliability Component
257
Peer to Peer Power Management Component
258
Usage/ Consumption Management Component
259
Load Management Component
260
Electrical Power Generation Management Component
261
IED Inventory Component
262
IED Maintenance Component
263
IED Fraud Detection Component
264
Power Quality Monitoring Component
265
Power Outage Component
284
Protocol Stack
286
Data Communications Interface
283

Figure 3a

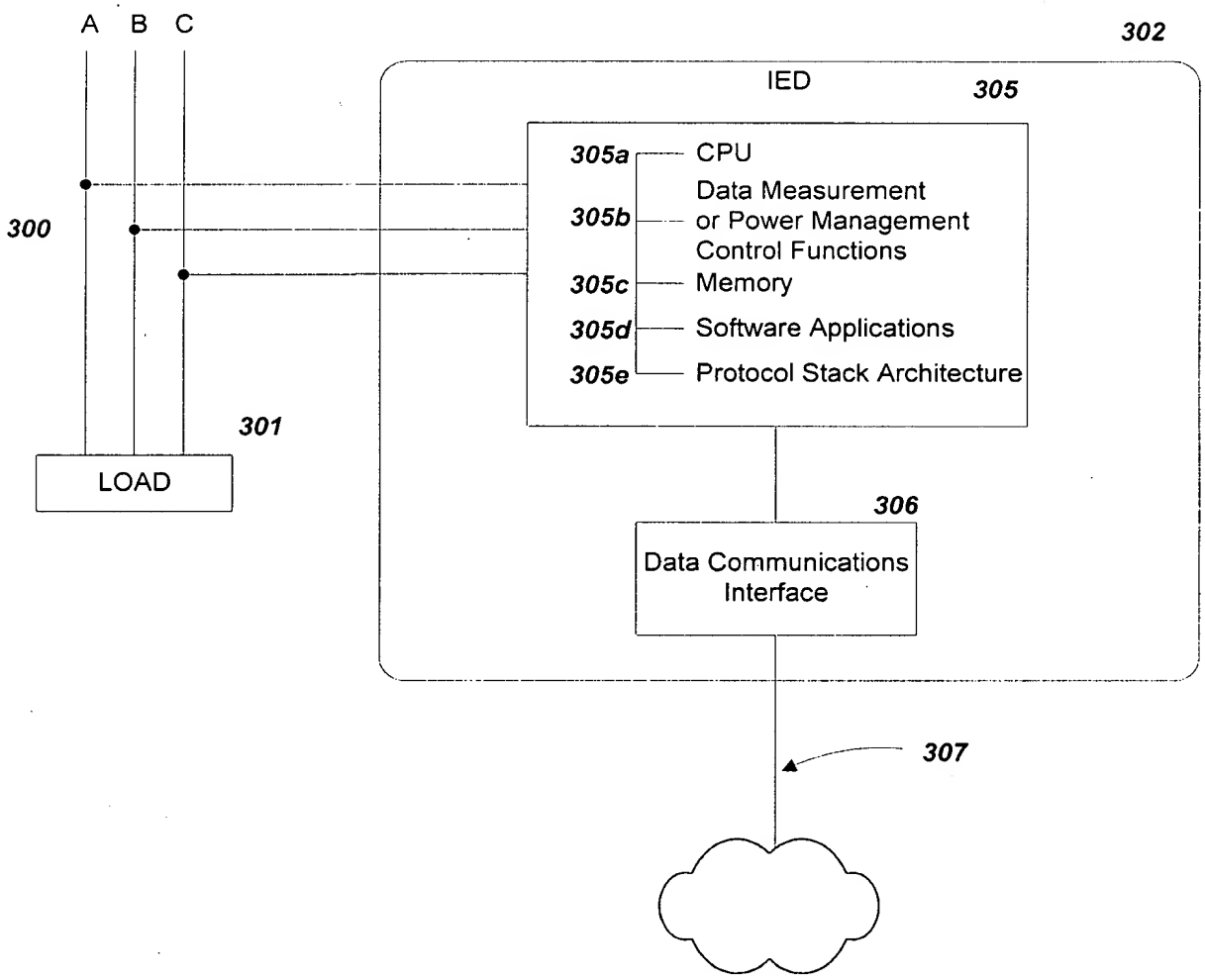

A
B
C
302
IED
305
305a
CPU
Data Measurement
or Power Management
Control Functions
305b
305c
Memory
305d
Software Applications
305e
Protocol Stack Architecture
300
301
LOAD
306
Data Communications
Interface
307

Figure 3b

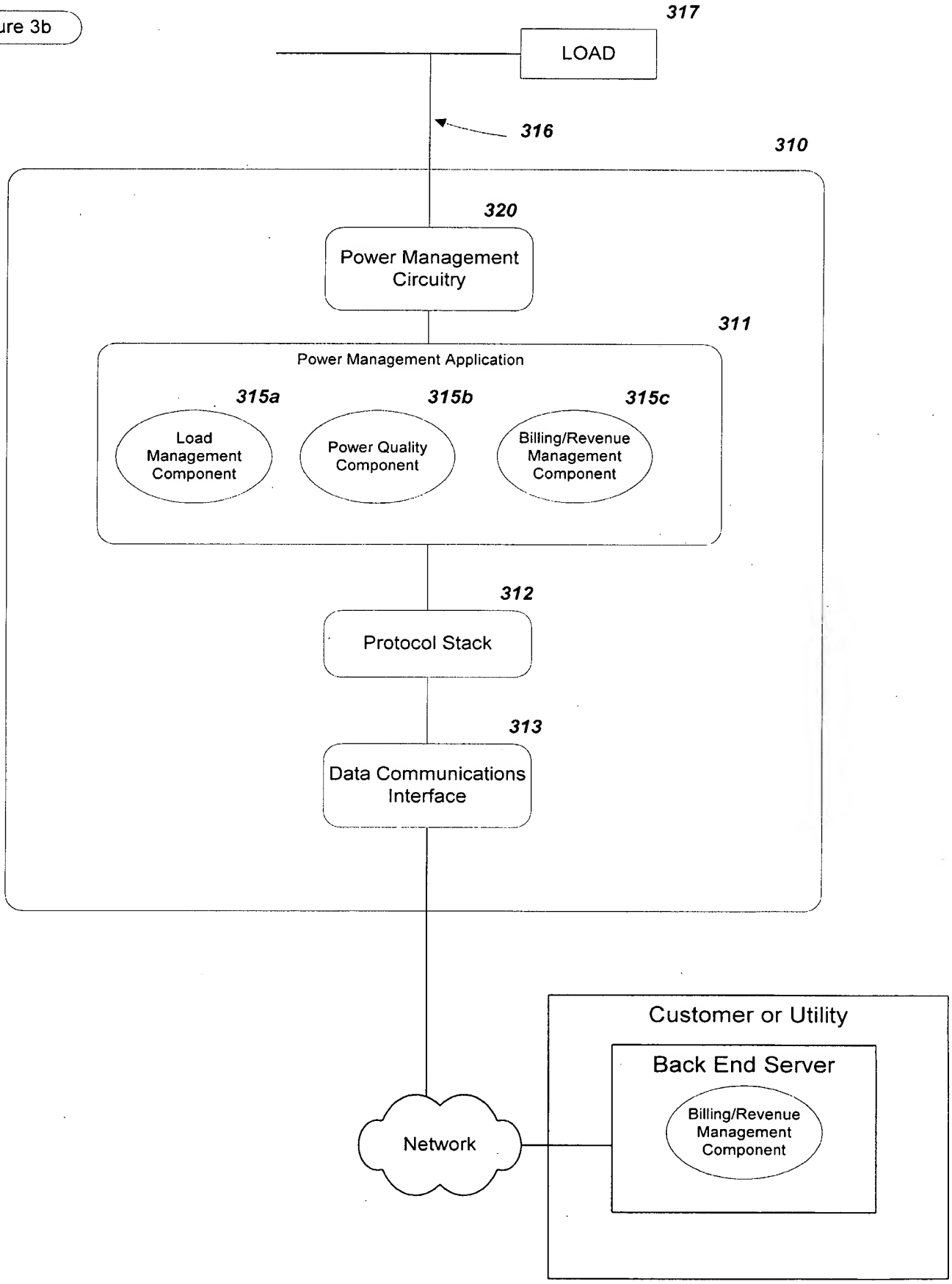

317
LOAD
316
310
320
Power Management Circuitry
311
Power Management Application
315a
Load Management Component
315b
Power Quality Component
315c
Billing/Revenue Management Component
312
Protocol Stack
313
Data Communications Interface
Network
Customer or Utility
Back End Server
Billing/Revenue Management Component

Figure 3c

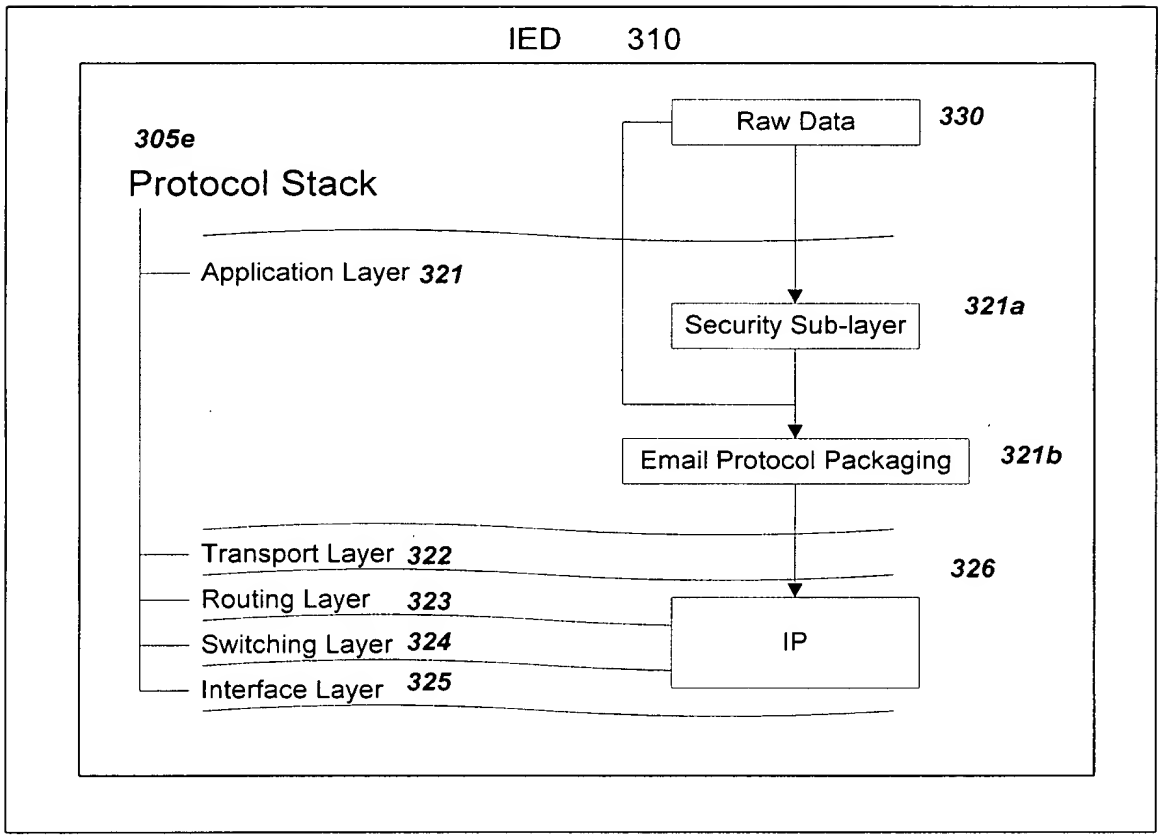

IED 310
305e
Protocol Stack
Application Layer 321
Transport Layer 322
Routing Layer 323
Switching Layer 324
Interface Layer 325
Raw Data
330
Security Sub-layer
321a
Email Protocol Packaging
321b
326
IP

Figure 4a

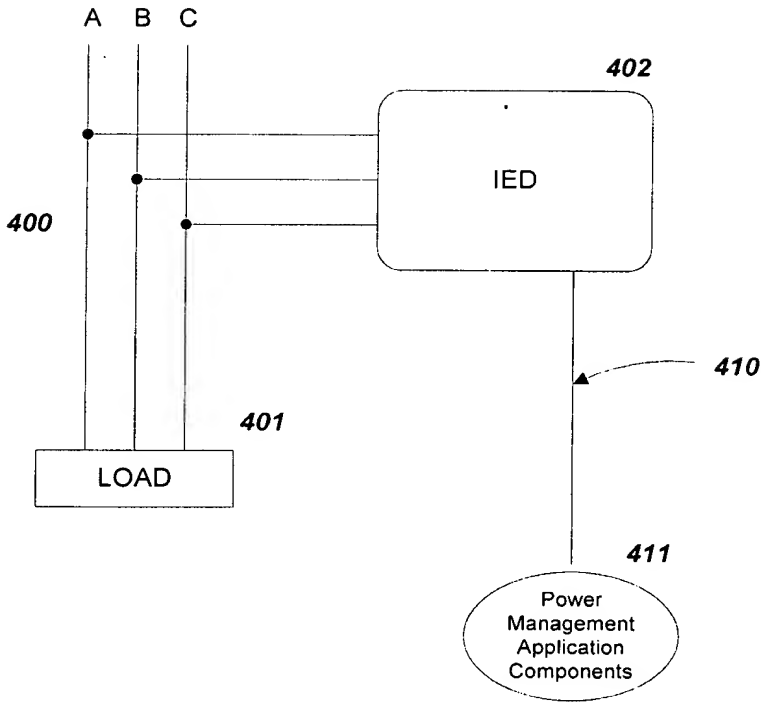

A
B
C
402
IED
400
410
401
LOAD
411
Power
Management
Application
Components

Figure 4b

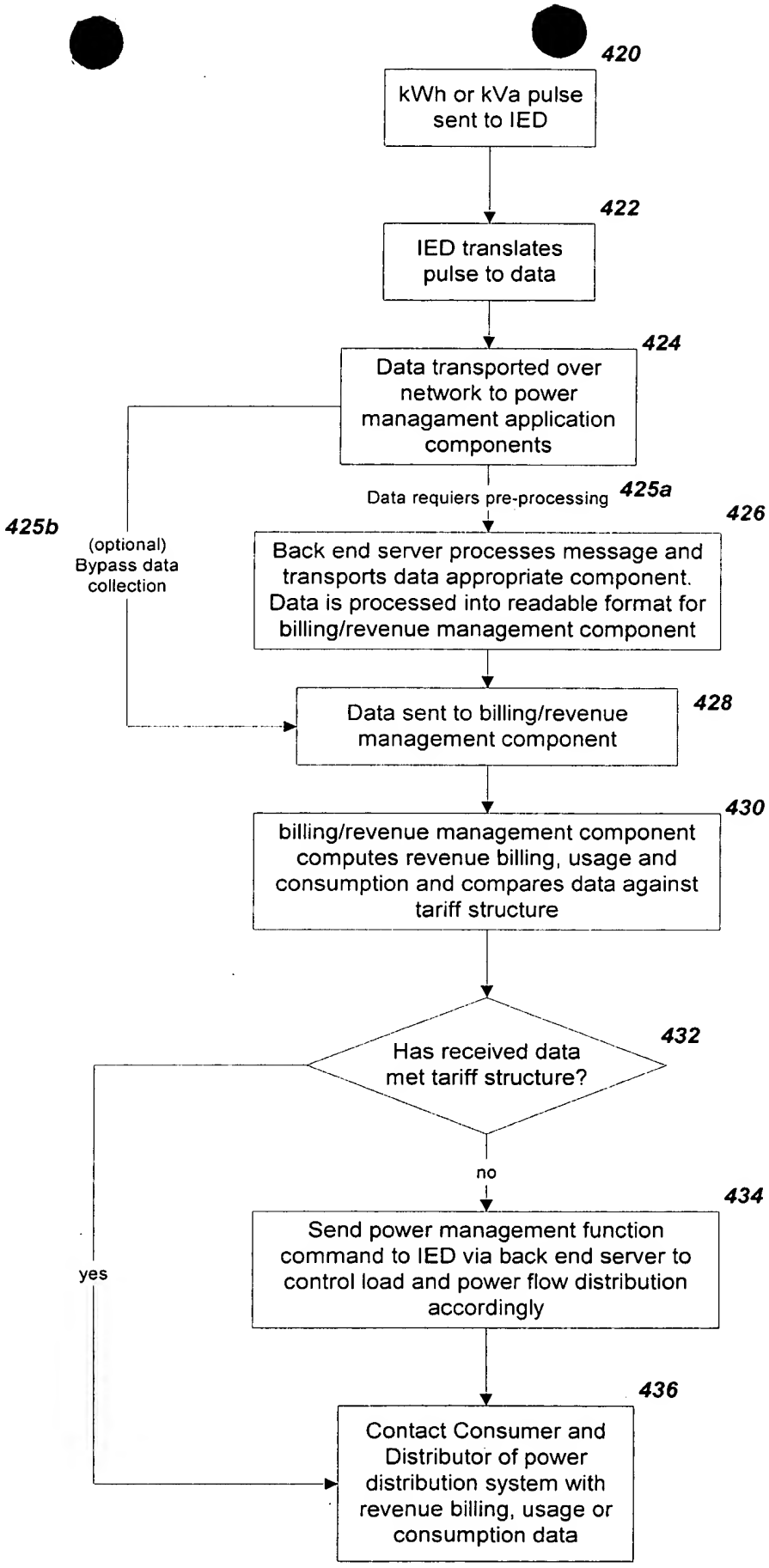

420
kWh or kVa pulse sent to IED
422
IED translates pulse to data
424
Data transported over network to power managament application components
Data requiers pre-processing
425a
425b
(optional) Bypass data collection
426
Back end server processes message and transports data appropriate component. Data is processed into readable format for billing/revenue management component
Data sent to billing/revenue management component
428
430
billing/revenue management component computes revenue billing, usage and consumption and compares data against tariff structure
Has received data met tariff structure?
432
no
yes
434
Send power management function command to IED via back end server to control load and power flow distribution accordingly
436
Contact Consumer and Distributor of power distribution system with revenue billing, usage or consumption data

Figure 5a

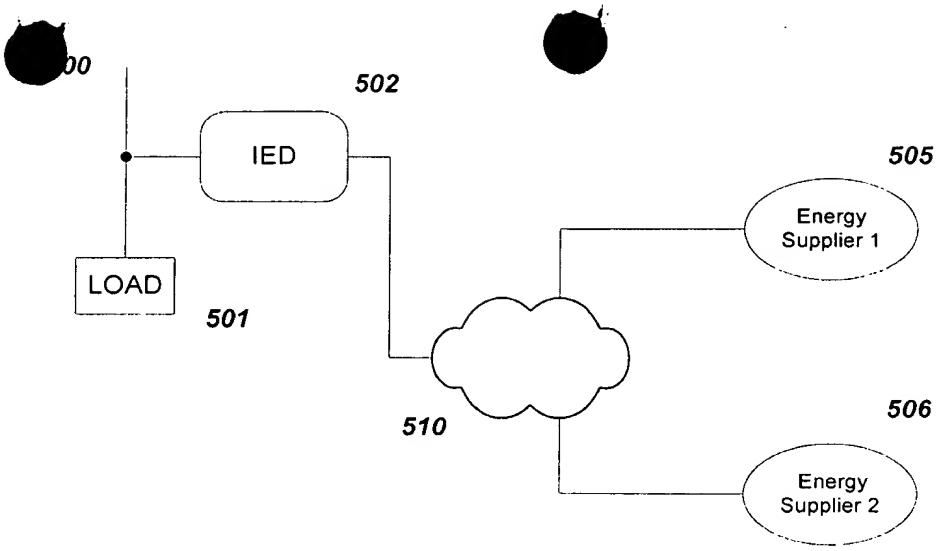


Figure 5b

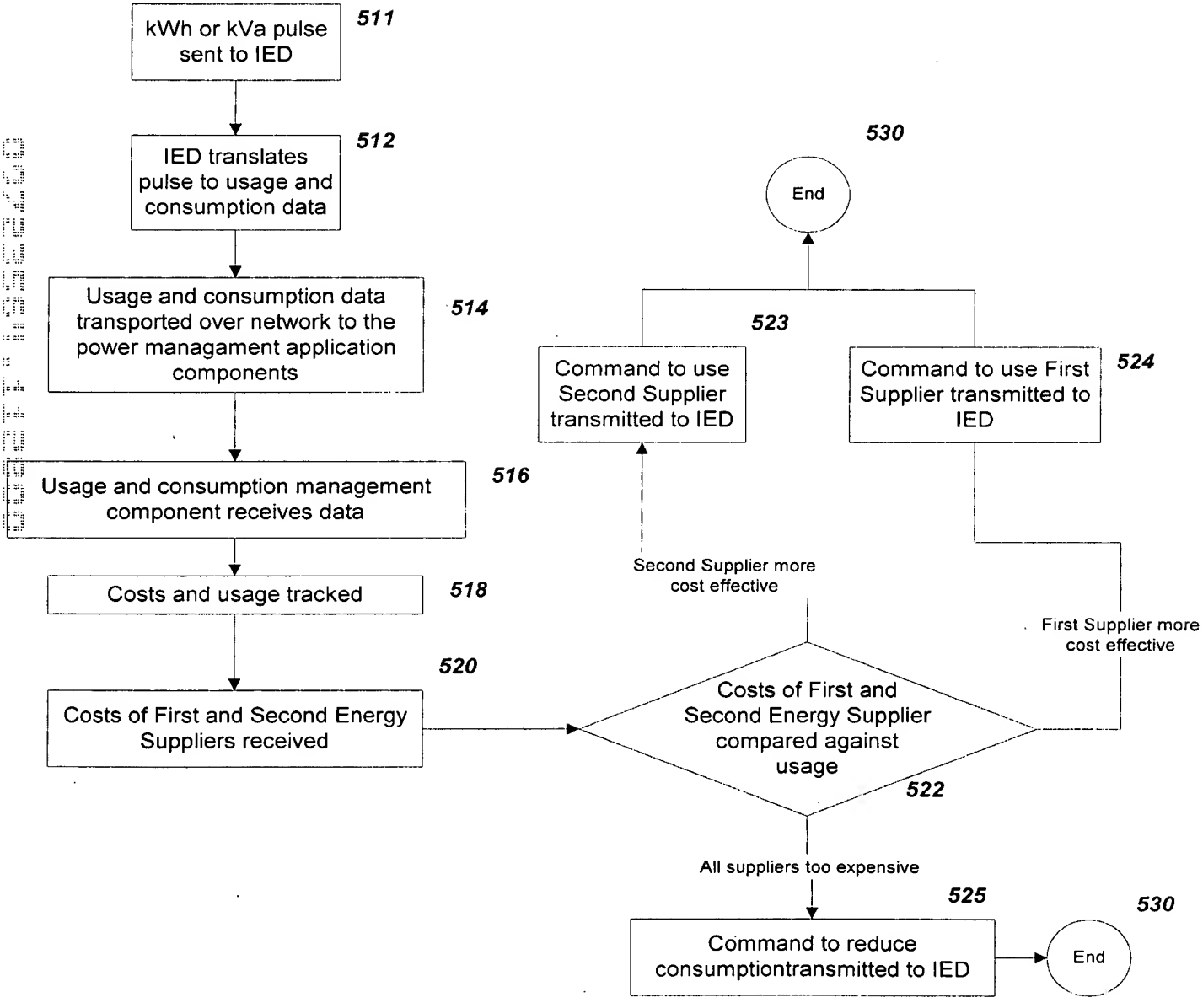


Figure 6

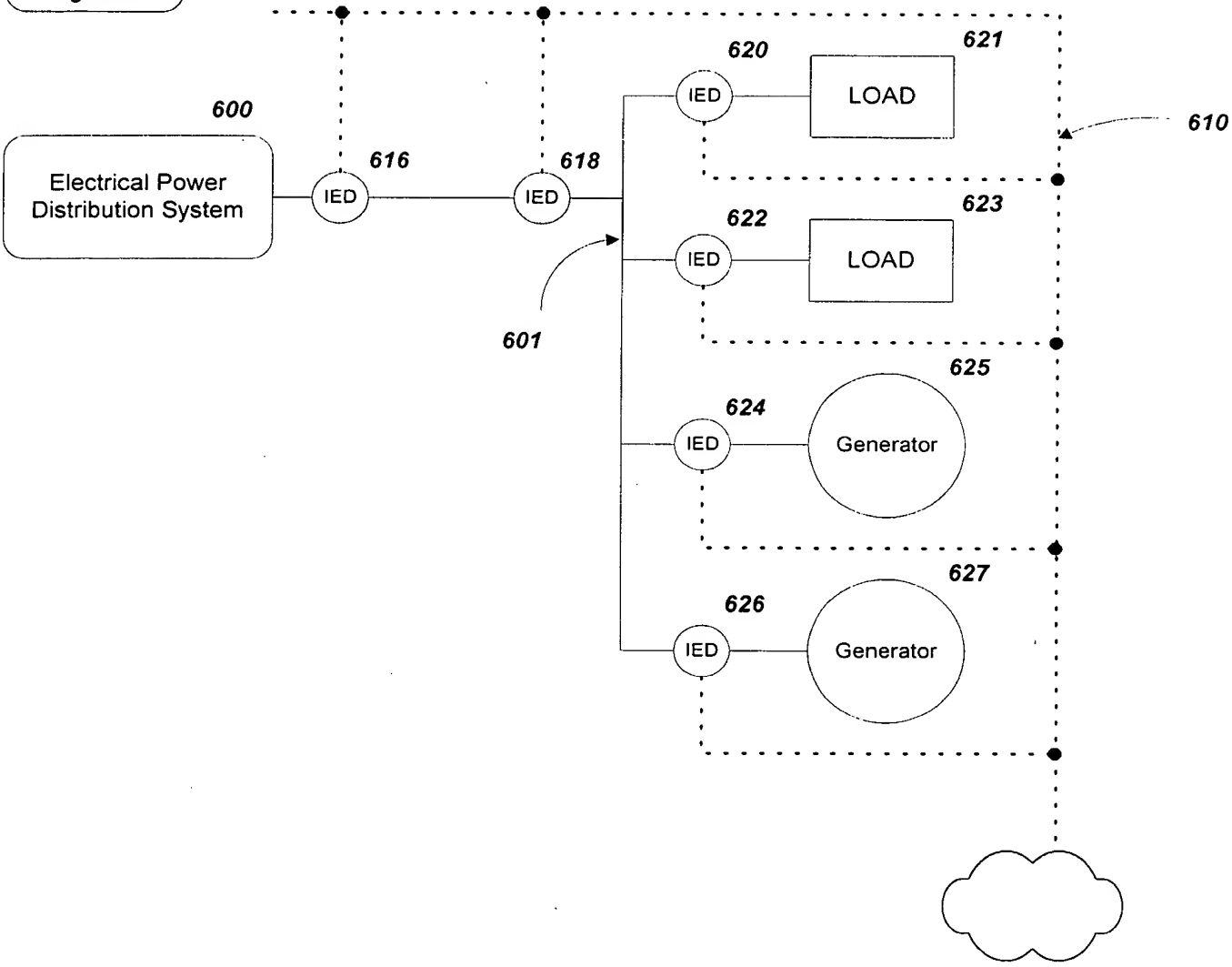

600
Electrical Power Distribution System
616
IED
618
IED
601
620
IED
LOAD
621
610
622
IED
LOAD
623
624
IED
Generator
625
626
IED
Generator
627

Figure 7

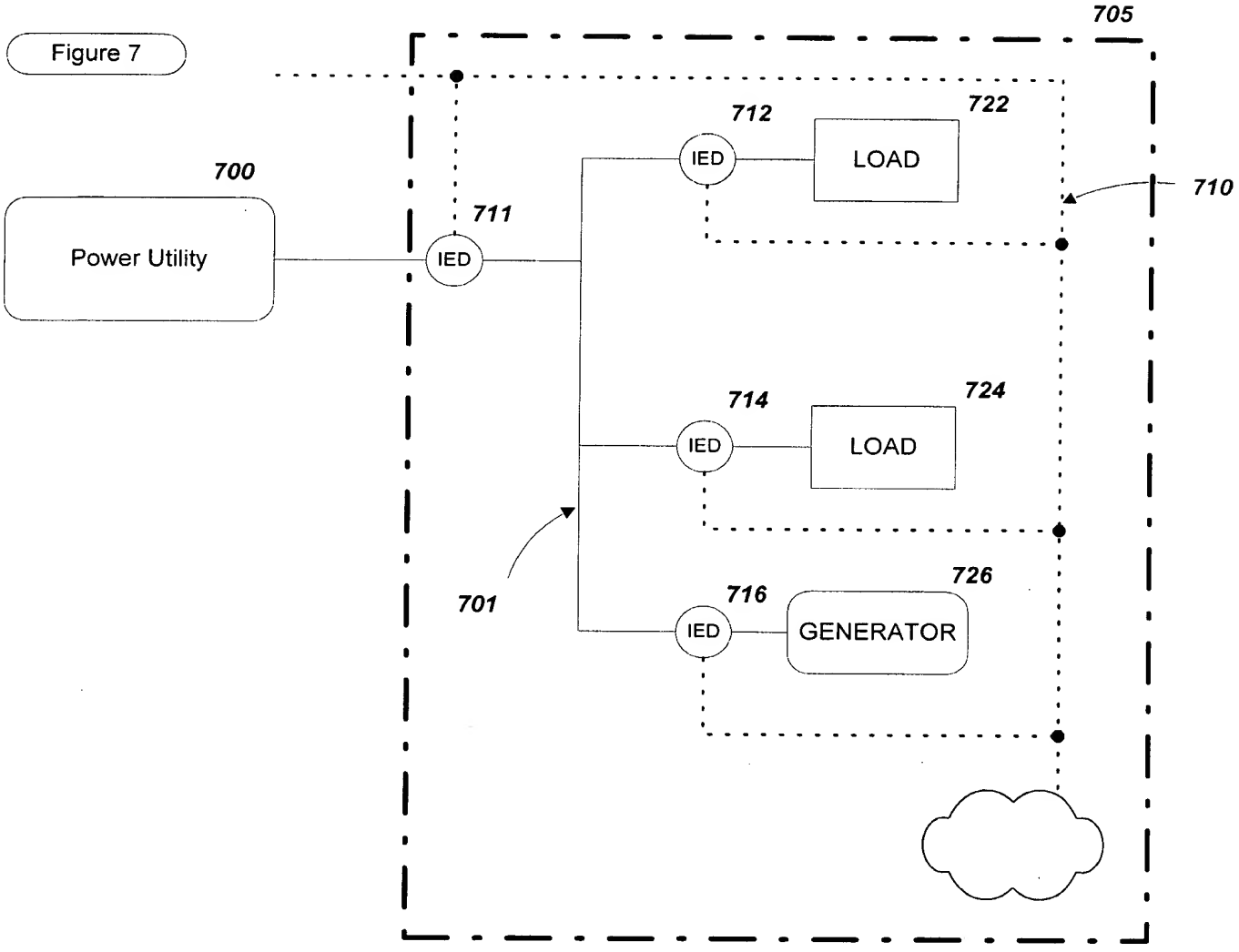

705
712
722
700
IED
LOAD
710
711
Power Utility
IED
714
724
IED
LOAD
701
726
716
IED
GENERATOR

Figure 8

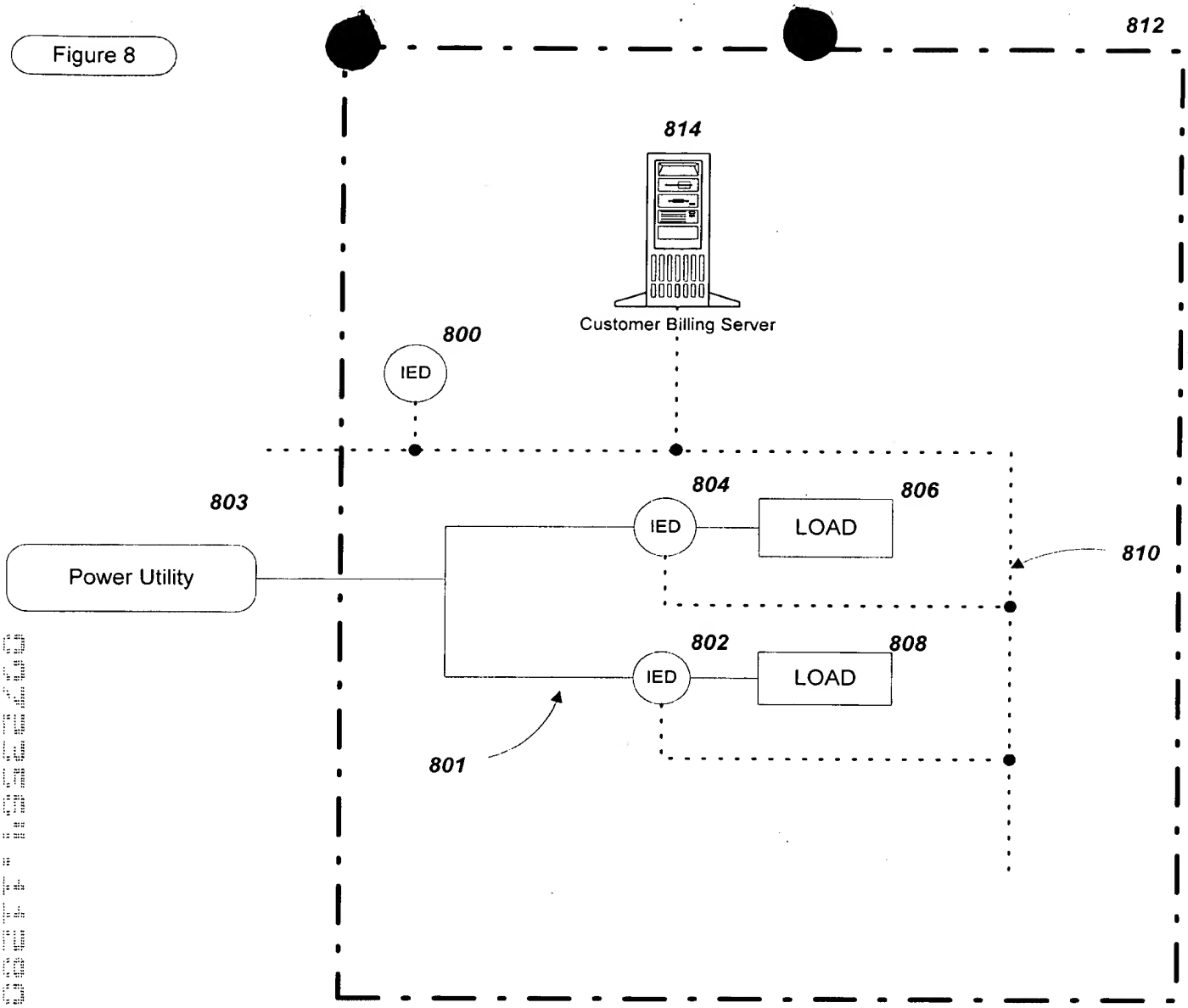

812
814
Customer Billing Server
800
IED
803
804
806
IED
LOAD
Power Utility
810
802
808
IED
LOAD
801

Figure 9

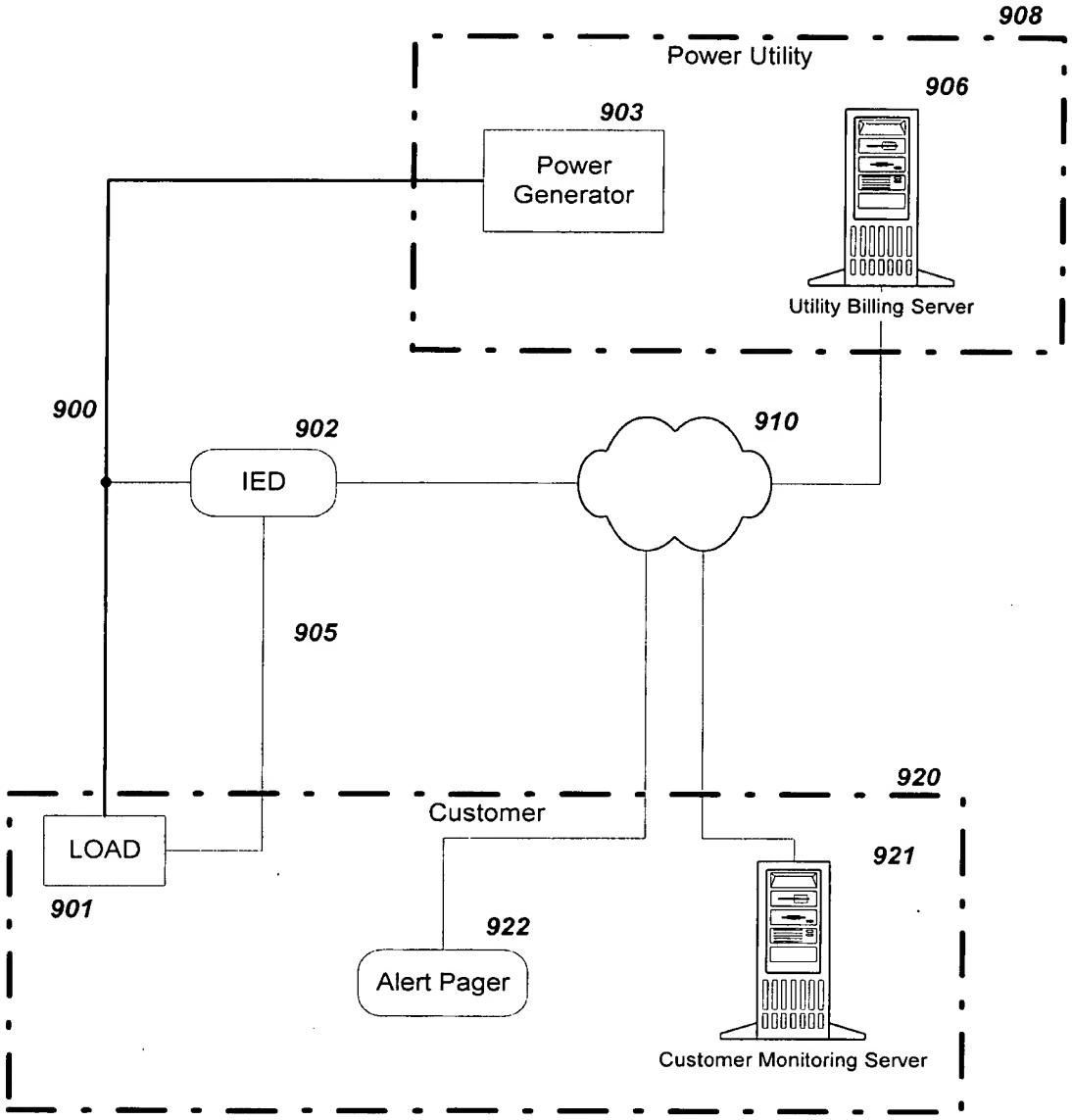
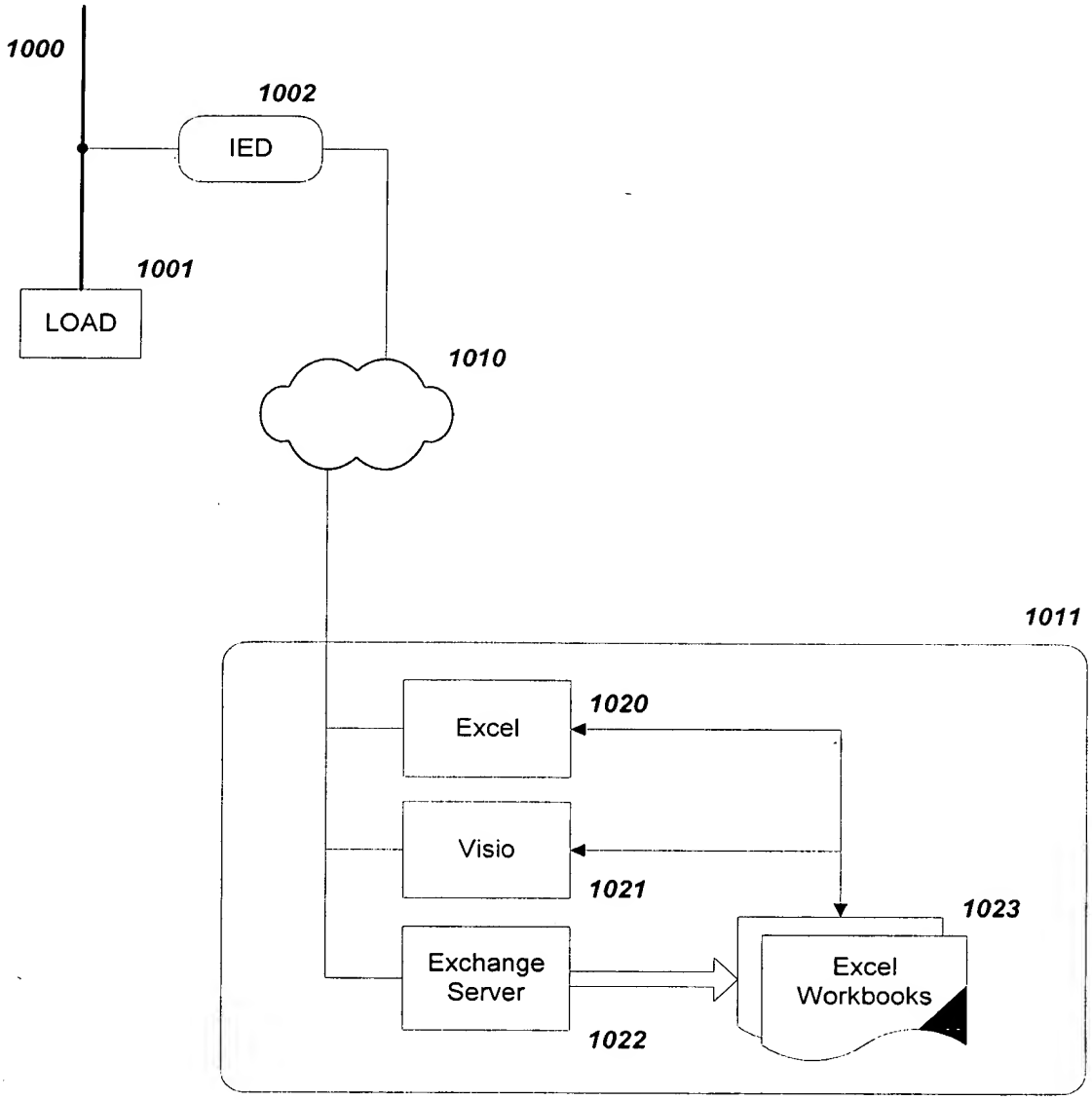

908
Power Utility
906
903
Power Generator
Utility Billing Server
900
902
910
IED
905
920
Customer
LOAD
921
901
922
Alert Pager
Customer Monitoring Server

Figure 10


1000
1002
IED
1001
LOAD
1010
1011
Excel
1020
Visio
1021
1023
Exchange Server
Excel Workbooks
1022

Site1.a8500

Default Diagram

LABEL	VALUE
I a	197.97
I b	207.52
I c	237.82
Vln c	479.28
Vln b	371.46
Vll ca	580.46
Vll ab	589.1
Vll bc	586.28
Vll avg	585.28
Vln avg	357.23
I avg	214.44
PF sign tot	-94
Freq	59
CL1 LocalTime	08:32.9

Sum of Currents: 643.31

Formula-based Setpoint: OVER 550 Volts

Change Update Rate
Type in the number of seconds you would like between page updates and hit <RETURN> 10

Some features to implement:
Auto-detection: Excel could automatically add a worksheet (a "tab" below) when it detects a new device on the network
Complex Aggregation: Because it is Excel, you can do anything you want, easily
Logging: You could write simple scripts to log the values on the left to an Access DE
Animation: Charts, warnings, etc
Onboard logs could be displayed easily
Default diagrams: we just need to create an excel template for each device

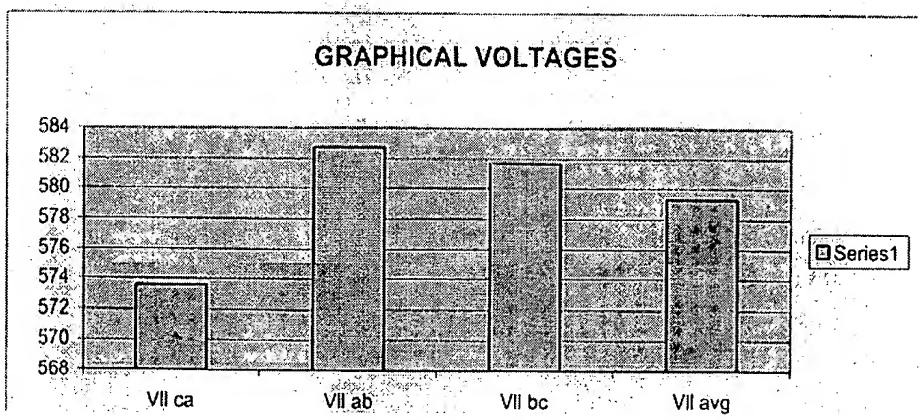


Figure 11